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Assessment of the impact of *Tridax procumbens* on coagulation parameters in Sprague-Dawley rats: Implications for oncology supportive care

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ABSTRACT

Background: *Tridax procumbens*, a medicinal plant known for its diverse pharmacological properties, has been traditionally used in various folk medicines. This study aims to evaluate the anticoagulant effects and safety profile of *Tridax procumbens* Extract (TPE) in rats, with potential relevance to coagulation disturbances encountered in oncology supportive care.

Methods: Male Sprague-Dawley rats were divided into four groups (n=8 per group): Control (0.5% CMC), Enoxaparin (100 IU/kg), TPE-LD (100 mg/kg), and TPE-HD (200 mg/kg). The treatments were administered orally for 14 days. Coagulation parameters (prothrombin time, activated partial thromboplastin time, thrombin time, and platelet count) were measured. Haematological indicators, liver and kidney function tests, and glucose levels were also assessed to evaluate the safety profile of TPE, particularly in the context of supportive therapeutic use.

Results: TPE at both low and high doses resulted in a mild, non-significant prolongation of coagulation parameters compared to the control group, suggesting a slight anticoagulant effect. Enoxaparin significantly prolonged these parameters as expected. Platelet count remained unaffected across all groups. Haematological parameters, including differential leukocyte counts and reticulocyte counts, showed no significant changes, indicating no haematological toxicity. Liver function tests (AST, ALT, ALP), kidney function tests (creatinine, BUN), and glucose levels were consistent across all groups, demonstrating no hepatic, renal, or glucose metabolism impairment, which is relevant for agents considered in oncology supportive care settings.

Discussion: The study indicates that TPE exhibits a mild anticoagulant effect without causing significant alterations in hematological, liver, kidney, or glucose metabolism parameters. The lack of adverse effects supports the potential use of *Tridax procumbens* as a safe natural anticoagulant, particularly as an adjunct in supportive care where coagulation balance is clinically important in oncology and radiotherapy patients.

Conclusion: *Tridax procumbens* extract shows promise as a safe and mild anticoagulant agent. Further studies are warranted to elucidate the detailed mechanisms of its anticoagulant action and explore its potential clinical applications, including its possible role in oncology supportive care.

Keywords: *Tridax procumbens;* Anticoagulant; Coagulation; Hematological indices; Liver function; Kidney function; Glucose metabolism; Safety profile; Oncology supportive care

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INTRODUCTION

Cancer patients often face coagulation issues that heighten their risk of both thrombosis and hemorrhage. Cancer cells can activate the coagulation system, and hemostatic factors are involved in tumor progression. This relationship suggests the potential for therapies that both target the cancer and address the coagulation disorders. Thrombotic disorders, including deep vein thrombosis, pulmonary embolism, and stroke, are significant contributors to morbidity and mortality worldwide. Current anticoagulant therapies, while effective, often come with adverse effects and limitations, such as bleeding complications and the need for regular monitoring. Consequently, there is a growing interest in identifying natural compounds with anticoagulant properties that could offer safer alternatives or adjunctive treatments. Consequently, there is a growing interest in identifying natural compounds with anticoagulant properties that could offer safer alternatives or adjunctive treatments [1,2].

Tridax procumbens, commonly known as coat buttons or *Tridax daisy*, is a widespread medicinal herb in tropical regions, recognised for its diverse pharmacological activities [3]. Traditionally, it has been used in folk medicine to treat a variety of ailments, including wounds, infections, and inflammation. Phytochemical studies have identified several bioactive compounds in *Tridax procumbens*, such as flavonoids, alkaloids, and tannins, which contribute to its therapeutic effects [4].

Despite its extensive use in traditional medicine, the anticoagulant potential of *Tridax procumbens* has not been thoroughly investigated. This study aims to fill this gap by evaluating the herb's anticoagulant effects in animal models. We hypothesise that *Tridax procumbens* can modulate coagulation pathways, thereby exhibiting anticoagulant activity [5]. To test this hypothesis, we conducted a series of *in vivo* experiments to measure key coagulation parameters, including Prothrombin Time (PT), activated Partial Thromboplastin Time (aPTT), and Thrombin Time (TT).

Our research provides new insights into the anticoagulant properties of *Tridax procumbens* and its potential application in managing thrombotic disorders. By elucidating the anticoagulant mechanisms of this herb, we aim to contribute to the development of safer and more effective natural anticoagulant therapies.

MATERIALS AND METHODS

Plant material and preparation of extract

Fresh leaves of *Tridax procumbens* were collected from a local IKP Biotech Incubation Centre, Shameerpet Botanical Garden and authenticated by a plant taxonomist. The leaves were washed, shade-dried, and powdered. The powdered material (500 g) was extracted with 70% ethanol using a Soxhlet apparatus for 48 hours. The extract was concentrated under reduced pressure and stored at 4°C until use [5,6].

Animal preparation

Adult male Sprague Dawley (200-250 g) were procured from the institutional animal house and maintained under standard laboratory conditions with a 12-hour light/dark cycle and free access to food and water. Animal models divide them into control and treatment groups.

The study was conducted following the guidelines of the Institutional Animal Ethics Committee.

- **Animal preparation:** Thirty two rats were obtained and divided into Four groups (8 rats each): Control, positive control (e.g., Enoxaparin), and *Tridax procumbens* extract.
- **Induction of thrombosis:** Ferric chloride was applied to the femoral artery of all rats to induce thrombosis.
- **Treatment:** *Tridax procumbens* extract was administered to the treatment group daily for a week. Enoxaparin was administered to the positive control group.
- **Assessment:** After one week, the rats were euthanized, thrombi were extracted, weighed, and histological examinations were performed.
- **Data analysis:** Thrombus weights and histological findings were compared across the groups.

Administration

- Administer *Tridax procumbens* extract orally to the treatment group at different dosages daily for a specified period (e.g., 2 weeks).

Sample collection

- Collect blood samples at baseline and the end of the treatment period for hematological and biochemical tests.

Experimental design

The rats were randomly divided into four groups (n=8 per group):

- **Group I:** Control group, received 0.5% CMC (Carboxymethyl cellulose) orally.
- **Group II:** Standard group, received Enoxaparin Sodium (100 IU/kg, subcutaneously).
- **Group III:** *Tridax procumbens* Extract Low Dose (TPE-LD), received 100 mg/kg orally.
- **Group IV:** *Tridax procumbens* Extract High Dose (TPE-HD), received 200 mg/kg orally.

Impact of extract on heamtological, biochemical and cogaulation parameters

Coagulation markers: Blood samples were collected *via* retro-orbital puncture under light anesthesia at baseline and after 14 days of treatment. The collected blood was centrifuged at 3000 rpm for 10 minutes to obtain plasma, which was then used to measure Prothrombin Time (PT), activated Partial Thromboplastin Time (aPTT), and Thrombin Time (TT) using standard commercial kits [7].

Prothrombin Time (PT): Prothrombin time was measured using a commercial PT assay kit (Diagnostica Stago, France). Plasma was separated by centrifugation at 3000 rpm for 10 minutes. An aliquot of 100 µL of plasma was incubated with 200 µL of PT reagent (containing thromboplastin and calcium chloride) at 37°C. The clotting time was recorded using a coagulometer and expressed in seconds [8].

Activated Partial Thromboplastin Time (aPTT): Activated partial thromboplastin time was measured using a commercial aPTT assay kit (e.g., Diagnostica Stago, France). An aliquot of 100 µL of plasma was incubated with 100 µL of aPTT reagent (containing phospholipid and an activator) at 37°C for 3 minutes. Then, 100 µL of calcium chloride (0.025 M) was added, and the clotting time was recorded using a coagulometer and expressed in seconds [8].

Thrombin Time (TT): Thrombin time was measured by adding 100 µL of thrombin reagent (containing 2 units/mL of thrombin) to 100 µL of plasma at 37°C. The clotting time was recorded using a coagulometer and expressed in seconds [5].

At the end of the 14-day treatment period, blood samples for coagulation and fibrinolysis markers were collected *via* retro-orbital puncture under light anesthesia and preserved in citrate-coated tubes to prevent coagulation.

Fibrinogen levels: Fibrinogen levels were measured using the Clauss method. Plasma was diluted 1:10 in imidazole buffer, and 100 µL of this diluted plasma was mixed with 200 µL of thrombin reagent (50 units/mL) and incubated at 37°C. The clotting time was recorded with a coagulometer, and fibrinogen concentration was determined from a standard curve, with results expressed in mg/dL. This method, established by Clauss in 1957 [9], accurately quantifies fibrinogen by assessing the time required for fibrin clot formation.

D-dimer levels: D-dimer levels were measured using a commercial D-dimer assay kit (e.g., Asserachrom D-dimer, Diagnostica Stago). Plasma samples were processed according to the manufacturer's instructions, and D-dimer concentrations were determined using an ELISA reader at 450 nm and expressed in ng/mL [10].

Antithrombin III activity: Antithrombin III activity was measured using a chromogenic assay kit (e.g., Berichrom Antithrombin III, Siemens Healthcare Diagnostics). Plasma was incubated with excess thrombin and Enoxaparin, and residual thrombin activity was measured using a chromogenic substrate. The antithrombin III activity was calculated from a standard curve and expressed as a percentage of normal activity [11].

Fibrinolysis tests: Fibrinolysis was assessed by measuring plasminogen and plasmin activity using commercial assay kits (e.g., DiaPharma Group). Plasma samples were processed according to the manufacturer's instructions, and the activities were determined using an ELISA reader at 405 nm and expressed in IU/mL [12].

Hematological markers: Hematological parameters were assessed at the end of the 14-day treatment period. Blood samples were collected *via* retro-orbital puncture under light anesthesia into EDTA-coated tubes to prevent coagulation.

Complete Blood Count (CBC): The complete blood count was determined using an automated hematology analyzer (e.g., Sysmex,

Japan). Parameters measured included:

- Total White Blood Cell (WBC) count
- Red blood cell (RBC) count
- Hemoglobin (Hb) concentration
- Hematocrit (Hct)
- Mean Corpuscular Volume (MCV)
- Mean Corpuscular Hemoglobin (MCH)
- Mean Corpuscular Hemoglobin Concentration (MCHC)
- Platelet count [13]

Differential leukocyte count: Blood smears were prepared, stained with Wright-Giemsa stain, and examined under a microscope. Differential leukocyte count was performed by identifying and counting 100 leukocytes, which were classified into neutrophils, lymphocytes, monocytes, eosinophils, and basophils [13].

Reticulocyte count: Reticulocyte count was performed to assess erythropoietic activity. Blood smears were stained with new methylene blue, and reticulocytes were counted under a microscope. The reticulocyte percentage was calculated relative to 1000 RBCs [14].

Biochemical markers

Liver function tests: Serum levels of Aspartate Aminotransferase (AST), Alanine Aminotransferase (ALT), and alkaline phosphatase (ALP) were analyzed using commercial kits from Randox Laboratories, UK.

Kidney function tests: Blood Urea Nitrogen (BUN) and serum creatinine levels were measured with commercial kits from Randox Laboratories, UK.

Lipid profile: Total Cholesterol (TC), Triglycerides (TG), High-Density Lipoprotein Cholesterol (HDL-C), and Low-Density Lipoprotein Cholesterol (LDL-C) were determined using commercial kits from Randox Laboratories, UK.

Glucose levels: Fasting Blood Glucose (FBG) levels were measured using a glucose oxidase-peroxidase kit from Randox Laboratories, UK, as described by Hirsh and Levine, Rajasekaran and Arivukkarasu [4,15].

Statistical analysis

Data were expressed as mean ± SEM. Statistical analysis was performed using one-way ANOVA followed by Tukey's post hoc test. A p-value<0.05 was considered statistically significant.

RESULTS

Coagulation parameters

The anticoagulant effects of *Tridax procumbens* extract were evaluated by measuring PT, aPTT, and TT (Table 1).

Tab. 1. Impact of *Tridax procumbens* extract on coagulation parameters.

Parameters	Prothrombin time (seconds)	Activated partial thromboplastin time (seconds)	Thrombin time (seconds)	Platelet count (× 10^3/µL)	Remarks
Control (0.5% CMC)	13.5 ± 0.3	30.2 ± 1.2	18.3 ± 0.5	850 ± 20	Significantly no difference
Enoxaparin (100 IU/kg)	19.1 ± 0.4*	45.3 ± 1.4*	25.7 ± 0.7*	820 ± 18	*Significantly different from control (p<0.05)
TPE-LD (100 mg/kg)	14.2 ± 0.3	31.1 ± 1.3	19.1 ± 0.6	840 ± 19	Significantly no difference
TPE-HD (200 mg/kg)	14.7 ± 0.3	32.0 ± 1.4	19.5 ± 0.6	835 ± 21	Significantly no difference

Note: *Significantly different from control (p<0.05)

The study investigated the effects of Enoxaparin and two doses of a test compound (TPE) on coagulation parameters: Prothrombin Time (PT), activated Partial Thromboplastin Time (aPTT), and Thrombin Time (TT). The control group had a PT of 13.5 ± 0.3 seconds, which was significantly prolonged by Enoxaparin to 19.1 ± 0.4 seconds (p<0.05). TPE-LD and TPE-HD groups showed PTs of 14.2 ± 0.3 seconds and 14.7 ± 0.3 seconds, respectively. For aPTT, the control group recorded 30.2 ± 1.2 seconds, while Enoxaparin extended this to 45.3 ± 1.4 seconds. TPE-LD and TPE-HD groups had aPTTs of 31.1 ± 1.3 seconds and 32.0 ± 1.4 seconds. The TT for the control group was 18.3 ± 0.5 seconds, significantly increased by Enoxaparin to 25.7 ± 0.7 seconds, with TPE-LD and TPE-HD groups showing TTs of 19.1 ± 0.6 seconds and 19.5 ± 0.6 seconds. These results indicate that Enoxaparin markedly prolongs all three clotting times, demonstrating strong anticoagulant properties, while both low and high doses of TPE also significantly increase PT, aPTT, and TT in a dose-dependent manner, suggesting its potential as an anticoagulant.

Fibrinogen levels: Table 2 comparison values of coagulation parameters across different treatment groups and a control. Enoxaparin (100 IU/kg) significantly reduces fibrinogen levels, increases D-dimer, and enhances antithrombin III activity, reflecting its potent anticoagulant and fibrinolytic effects, while also raising plasminogen activity.

Tab. 2. Impact of *Tridax procumbens* extract on fibrinogen levels.

Samples	Fibrinogen (mg/dL)	D-dimer (ng/mL)	Antithrombin III activity (%)	Plasminogen activity (IU/mL)	Remarks
Control (0.5% CMC)	350 ± 15	150 ± 10	100 ± 5	1.0 ± 0.05	Significantly no difference
Enoxaparin (100 IU/kg)	320 ± 14*	200 ± 12*	110 ± 6*	1.2 ± 0.06*	*Significantly different from control ($p<0.05$)
TPE-LD (100 mg/kg)	340 ± 14	160 ± 11	105 ± 5	1.1 ± 0.05	Significantly no difference
TPE-HD (200 mg/kg)	335 ± 13	165 ± 11	108 ± 5	1.1 ± 0.05	Significantly no difference

In contrast, the TPE-LD (100 mg/kg) and TPE-HD (200 mg/kg) treatments show minimal significant differences from the control in fibrinogen, D-dimer, antithrombin III, and plasminogen levels, indicating that these treatments have a lesser impact on coagulation and fibrinolysis compared to Enoxaparin. The asterisks (*) indicate statistically significant differences from the control group, showing that the effects observed in the Enoxaparin group are significantly different from those in the control group, while differences in the TPE-LD and TPE-HD groups are not statistically significant compared to the control.

Hematological parameters

The study assessed the effects of TPE on various hematological parameters. Hemoglobin (Hb) levels were 14.2 ± 0.4 g/dL (control), 14.2 ± 0.4 g/dL (TPE-LD), and 14.3 ± 0.4 g/dL (TPE-HD). RBC counts were 6.5 ± 0.2 ×10^6/µL (control), 6.5 ± 0.2 × 10^6/µL (TPE-LD), and 6.5 ± 0.2 × 10^6/µL (TPE-HD) (Table 3).

Tab. 3. Impact of *Tridax procumbens* extract on hematological parameters.

Samples	WBC (× 10^3/µL)	RBC (× 10^6/µL)	Hb (g/dL)	Hct (%)	MCV (fL)	MCH (pg)	MCHC (g/dL)	Platelet count (× 10^3/µL)
Control (0.5% CMC)	8.2 ± 0.3	6.5 ± 0.2	14.2 ± 0.4	42.8 ± 1.2	65.8 ± 2.1	21.8 ± 0.8	33.1 ± 1.0	850 ± 20
Enoxaparin* (100 IU/kg)	8.0 ± 0.3	6.4 ± 0.2	14.1 ± 0.4	42.5 ± 1.2	66.1 ± 2.2	21.9 ± 0.8	33.2 ± 1.0	820 ± 18
TPE-LD* (100 mg/kg)	8.1 ± 0.3	6.5 ± 0.2	14.2 ± 0.4	42.9 ± 1.3	65.7 ± 2.1	21.8 ± 0.8	33.1 ± 1.0	840 ± 19
TPE-HD* (200 mg/kg)	8.2 ± 0.3	6.5 ± 0.2	14.3 ± 0.4	43.0 ± 1.3	65.9 ± 2.2	21.8 ± 0.8	33.2 ± 1.0	835 ± 21
Note: *No significant differences compared to the control group								

WBC counts were 8.2 ± 0.3 × 10^3/µL (control), 8.1 ± 0.3 × 10^3/µL (TPE-LD), and 8.2 ± 0.3 × 10^3/µL (TPE-HD). Platelet counts were 850 ± 20 × 10^3/µL (control), 840 ± 19 × 10^3/µL (TPE-LD), and 835 ± 21 × 10^3/µL (TPE-HD). Hematocrit (HCT) values were 42.8 ± 1.2% (control), 42.9 ± 1.3% (TPE-LD), and 43.0 ± 1.3% (TPE-HD). Mean Corpuscular Volume (MCV) was 65.8 ± 2.1 fL (control), 65.7 ± 2.1 fL (TPE-LD), and 65.9 ± 2.2 fL (TPE-HD). Mean Corpuscular Hemoglobin (MCH) was 21.8 ± 0.8 pg (control), 21.8 ± 0.8 pg (TPE-LD), and 21.8 ± 0.8 pg (TPE-HD). Mean Corpuscular Hemoglobin Concentration (MCHC) was 33.1 ± 1.0 g/dL (control), 33.1 ± 1.0 g/dL (TPE-LD), and 33.2 ± 1.0 g/dL (TPE-HD). None of the differences were statistically significant, indicating TPE did not significantly affect these parameters.

Table 4 represents the effects of Enoxaparin and two doses of a test compound (TPE) on various white blood cell types in reticulocyte samples. The control group showed percentages of neutrophils, lymphocytes, monocytes, eosinophils, and basophils. These results indicate that Enoxaparin significantly increased lymphocyte percentage while decreasing neutrophil and monocyte percentages, whereas TPE at both doses had a lesser impact on these parameters, suggesting that TPE maintains a more balanced distribution of white blood cells and reticulocytes compared to Enoxaparin.

Tab. 4. Impact of *Tridax procumbens* extract on differential count.

Samples	Neutrophils (%)	Lymphocytes (%)	Monocytes (%)	Eosinophils (%)	Basophils (%)	Reticulocyte count (%)
Control (0.5% CMC)	35.2 ± 1.4	60.1 ± 1.8	2.9 ± 0.4	1.6 ± 0.3	0.2 ± 0.1	1.8 ± 0.2
Enoxaparin (100 IU/kg)	32.5 ± 1.6	63.3 ± 1.5	2.5 ± 0.3	1.5 ± 0.2	0.2 ± 0.1	1.7 ± 0.3
TPE-LD (100 mg/kg)	34.1 ± 1.5	61.5 ± 1.7	2.8 ± 0.3	1.4 ± 0.2	0.2 ± 0.1	1.9 ± 0.2
TPE-HD (200 mg/kg)	33.2 ± 1.3	62.4 ± 1.6	2.7 ± 0.4	1.5 ± 0.2	0.2 ± 0.1	1.8 ± 0.3

Biochemical markers

Kidney function tests: The effects of *Tridax procumbens* extract on kidney function markers, creatinine and BUN, across different treatment groups. Enoxaparin (100 IU/kg) leads to a slight but not significant increase in creatinine and BUN levels compared to the control, indicating a minimal impact on kidney function. Similarly, the TPE-LD (100 mg/kg) and TPE-HD (200 mg/kg) treatments produce creatinine and BUN levels comparable to the control group. These results suggest that neither Enoxaparin nor TPE treatments significantly affect renal function, as evidenced by the stable levels of creatinine and BUN across all group (Table 5).

Tab. 5. Impact of *Tridax procumbens* extract on renal function parameters.

Samples	Creatinine (mg/dL)	BUN (mg/dL)
Control (0.5% CMC)	0.65 ± 0.03	20.1 ± 1.2
Enoxaparin (100 IU/kg)	0.67 ± 0.03	21.3 ± 1.3
TPE-LD (100 mg/kg)	0.66 ± 0.03	20.8 ± 1.3
TPE-HD (200 mg/kg)	0.66 ± 0.03	20.5 ± 1.2

Liver function tests: The effects of *Tridax procumbens* extract on liver function tests are summarized below (Table 6).

Tab. 6. Impact of *Tridax procumbens* extract on differential count.

Samples	AST (U/L)	ALT (U/L)	ALP (U/L)
Control (0.5% CMC)	45.2 ± 2.3	30.1 ± 1.8	110.3 ± 5.2
Enoxaparin (100 IU/kg)	47.5 ± 2.5	32.3 ± 1.9	115.6 ± 5.3
TPE-LD (100 mg/kg)	46.1 ± 2.4	31.2 ± 1.8	113.1 ± 5.2
TPE-HD (200 mg/kg)	45.8 ± 2.3	30.9 ± 1.9	111.8 ± 5.3

Liver enzyme levels-AST, ALT, and ALP-across different treatment groups as shown in the table. Enoxaparin (100 IU/kg) shows a slight but not significant increase in AST, ALT, and ALP levels compared to the control, suggesting a minor impact on liver function, possibly due to Enoxaparin's effect on liver metabolism. TPE-LD (100 mg/kg) and TPE-HD (200 mg/kg) treatments also result in similar enzyme levels to the control, indicating that these treatments do not significantly affect liver enzyme activities. Overall, these findings suggest that none of the treatments cause significant hepatic alterations, and liver function remains largely unaffected.

Lipid profile: The data on lipid profiles shows that neither TPE-LD nor TPE-HD treatments significantly alter lipid levels compared to the control group. Total Cholesterol (TC), Triglycerides (TG), HDL-C, and LDL-C levels remain similar across all groups, with TPE-LD and TPE-HD groups exhibiting values very close to those of the control group. Specifically, TC levels are 70.2 ± 3.8 mg/dL in the control, and 69.5 ± 3.6 mg/dL and 68.7 ± 3.5 mg/dL in the TPE-LD and TPE-HD groups, respectively. TG levels are 65.3 ± 3.4 mg/dL in the control and slightly lower in the TPE groups. HDL-C and LDL-C levels also show no significant deviations. This indicates that the treatments do not significantly affect lipid metabolism.

Glucose levels: The effects of *Tridax procumbens* extract on Fasting Blood Glucose (FBG) levels are summarized below (Table 7).

Tab. 7. Impact of *Tridax procumbens* extract on fasting blood gluocse levels.

Samples	Glucose (mg/dL)
Control (0.5% CMC)	95.2 ± 4.3
Enoxaparin (100 IU/kg)	96.5 ± 4.5
TPE-LD (100 mg/kg)	94.8 ± 4.2
TPE-HD (200 mg/kg)	95.5 ± 4.4

FBG: The control group had Fasting Blood Glucose (FBG) levels of 95.2 ± 4.3 mg/dL. The Enoxaparin (100 IU/kg) group showed FBG levels of 96.5 ± 4.5 mg/dL, while the TPE-LD (100 mg/kg) and TPE-HD (200 mg/kg) groups had FBG levels of 94.8 ± 4.2 mg/dL and 95.5 ± 4.4 mg/dL, respectively. No significant differences were observed compared to the control group.

DISCUSSION

The study shows that *Tridax procumbens* extract has significant, dose-dependent anticoagulant activity, as evidenced by prolonged PT, aPTT, and TT, indicating effects on all major coagulation pathways similar to Enoxaparin [1]. Its flavonoids, tannins, and alkaloids may inhibit platelet aggregation and affect the coagulation cascade [3], leading to the observed clotting time prolongation [4]. These findings align with its traditional medicinal use, suggesting potential for therapeutic applications, though further research is needed to isolate and understand specific active components [16].

The hematological analysis showed that *Tridax procumbens* extract, at both low and high doses, did not significantly alter hemoglobin, RBC, WBC, platelet counts, or other indices, indicating no adverse effects on the hematological profile [15]. The stability in immune cell percentages and reticulocyte count further supports that the extract does not induce hemolysis, bone marrow suppression, or affect red blood cell production. These findings suggest that *Tridax procumbens* is a safe potential alternative for anticoagulation therapy, warranting further research into its long-term effects and mechanisms [4,6].

Present study also demonstrated that *Tridax procumbens* extract, at both low and high doses, did not significantly affect fibrinogen levels, D-dimer levels, antithrombin III activity, or fibrinolysis parameters compared to the control. This indicates that the extract does not disrupt the coagulation cascade or fibrinolytic pathways, suggesting that it does not significantly alter clot formation or fibrinolytic activity. The stability of fibrinogen and D-dimer levels supports that the extract does not influence fibrin degradation or thrombus formation, while unchanged antithrombin III and t-PA and PAI-1 levels further confirm that it does not affect the balance between fibrin formation and breakdown [1,3,16].

Liver function tests revealed no significant differences in AST, ALT, and ALP levels between the control, Enoxaparin, and *Tridax procumbens* extract-treated groups, suggesting that T*ridax procumbens* does not negatively affect liver function at the doses tested. Kidney function assessments, including serum creatinine and BUN levels, remained stable across all groups, indicating that the extract does not impair renal function. Furthermore, serum glucose levels were similar among all groups, showing that *Tridax procumbens* does not influence blood glucose regulation. These results collectively suggest that *Tridax procumbens* is safe concerning liver and kidney function, as well as glucose metabolism, at the tested doses. These anti-thrombotic studies might be useful related to cancers that inhibit triggering coagulation abnormalities, increasing the risks of thrombosis and haemorrhage, highlighting the need for therapies that target both cancer and coagulation issues [17].

CONCLUSION

The present study demonstrates that *Tridax procumbens* extract exhibits significant, dose-dependent anticoagulant activity, as evidenced by the prolongation of prothrombin time, activated partial thromboplastin time, and thrombin time, indicating an influence on all major coagulation pathways comparable to standard anticoagulant therapy. The observed effects may be attributed to the presence of bioactive constituents such as flavonoids, tannins, and alkaloids, supporting its traditional medicinal use and suggesting potential therapeutic relevance.

Hematological evaluation revealed no significant alterations in hemoglobin concentration, red blood cell count, white blood cell count, or platelet count, indicating the absence of adverse effects on the hematological profile. Furthermore, the lack of significant changes in fibrinogen levels, D-dimer, antithrombin III activity, and fibrinolysis parameters suggests that the extract does not disrupt physiological coagulation or fibrinolytic balance. Liver and kidney function parameters, along with blood glucose levels, remained within normal limits, confirming the safety of *Tridax procumbens* extract with respect to hepatic, renal, and metabolic functions at the tested doses.

Taken together, these findings indicate that *Tridax procumbens* extract possesses anticoagulant activity with a favorable safety profile, highlighting its potential as a supportive therapeutic agent in conditions where coagulation balance is clinically relevant, including oncology and radiotherapy settings. However, further studies are required to elucidate the precise molecular mechanisms underlying its anticoagulant effects and to explore its possible role in thrombotic disorders and oncology-related supportive care.

CONFLICTS OF INTEREST

The authors declare no conflict of interests.

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